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Treatment of fungus-induced rhinosinusitis, asthma, intestinal mucositis or otitis media, by mucoadministration of antifungal agent (Eng)

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NOVELTY - Treatment of noninvasive fungus-induced rhinosinusitis, asthma, noninvasive fungus-induced intestinal mucositis or noninvasive fungus-induced otitis media comprises mucoadministration of a formulation containing an antifungal agent (A) to at least a portion of the nasal-paranasal anatomy, the airways, the digestive tract or the middle ear respectively.

DETAILED DESCRIPTION

INDEPENDENT CLAIMS are also included for:
(a) an article consisting of the treatment of by mucoadministration of a formulation containing (A) to at least a portion of ;
(b) an article consisting of the formulation contained within packaging material including a label or package insert;
(c) the use of (A) for the manufacture of a medicament for use as above;
(d) an antifungal formulation comprising (A), a flavoring and at least 50 (preferably at least 85) wt.% water;
(e) a method for culturing fungus from the mucus of a mammal, obtaining a fungal antigen or producing a fungus-specific antibody involving (i) contacting the mucus with a mucolytic agent to reduce the viscosity, (ii) separating the fungus, (iii) contacting the fungus with a growth medium, (iv) incubating (giving cultured fungus), (v) optionally isolating the fungal antigen and (vi) optionally immunizing animal with the antigen to produce the antibody;
(f) nasal mucus collecting apparatus, comprising a collection retainer linked to a mucus collection tube (which is flexible to allow selective manipulation into a desired configuration collection procedure: and malleable so that it retains the desired configuration until manipulated to a different configuration) and a vacuum source; and
(g) a pharmaceutical composition comprising (A).

ACTIVITY

Antifungal.

MECHANISM OF ACTION

None given.

USE

For treating an inflamed nasal, lung, ear or intestinal area (e.g. sinusitis, asthma, otitis media or colitis), caused by the presence of a fungus, in mammals, especially humans. The rhinosinusitis is specifically characterized by polyp formation or polypoid change, and is especially chronic. The method is also useful for prophylactically; and for treating an immune response to a fungus in a mammal to eliminate or reduce the fungus below a threshold level at which it ceases to activate eosinophile migration to the affected area.

ADVANTAGE

The treatments are effective against even chronic conditions, and cause less side-effects and patient discomfort than steroid therapy or surgical treatment.
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(54) Title: METHODS AND MATERIALS FOR TREATING AND PREVENTING INFLAMMATION OFMUCOSAL TISSUE

(57) Abstract

The invention involves methods and materials for treating and preventing non–invasive fungus–induced mucositis. Specifically, the invention involves administrating an antifungal agent such that it contacts mucus in an amount, at a frequency, and for a duration effective to prevent, reduce, or eliminate non–invasive fungus–induced rhinosinusitis. This invention also provides methods and materials for diagnosing non–invasive fungus–induced rhinosinusitis and culturing non–invasive fungus from a mammalian mucus sample as well as specific antifungal formulations and medical devices for treating and preventing non–invasive fungus–induced rhinosinusitis. In addition, the invention provides methods and materials for treating and preventing other non–invasive fungus–induced mucositis conditions such as chronic otitis media, chronic colitis, and Crohn's disease. Further, the invention involves methods and materials for treating and preventing chronic asthma symptoms.

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WHAT IS CLAIMED IS:

1. A method for treating a mammal having non-invasive fungus-induced rhinosinusitis, comprising mucoadministering to at least a portion of the nasal-paranasal anatomy of said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced rhinosinusitis, said formulation comprising an antifungal agent.

2. The method of claim 1, wherein said mammal is a human.

3. The method of claim 1, wherein said mammal is nonatopic.

4. The method of claim 1, wherein said mammal is immunocompetent.

5. The method of claim 1, wherein said non-invasive fungus-induced rhinosinusitis is characterized by polyp formation or polypoid change.

6. The method of claim 1, wherein said non-invasive fungus-induced rhinosinusitis is chronic.

7. The method of claim 1, wherein said formulation is in a solid, liquid, or aerosol form.

8. The method of claim 1, wherein said formulation is in a form selected from the group consisting of a powder, crystalline substance, gel, paste, ointment, salve, cream, solution, suspension, partial liquid, spray, nebulae, mist, atomized vapor, aerosol, and tincture.

9. The method of claim 1, wherein said mucoadministration is a direct mucoadministration.

10. The method of claim 9, wherein said direct mucoadministration comprises irrigating said nasal-paranasal anatomy with a liquid form of said formulation.

11. The method of claim 9, wherein said direct mucoadministration comprises applying an aerosol form of said formulation to said nasal-paranasal anatomy.

12. The method of claim 9, wherein said direct mucoadministration comprises applying a powder form of said formulation to said nasal-paranasal anatomy.

13. The method of claim 1, wherein said antifungal agent comprises a macrolide.

14. The method of claim 1, wherein said antifungal agent comprises an azole.

15. The method of claim 1, wherein said antifungal agent interpolates fungal cell wall components.

16. The method of claim 1, wherein said antifungal agent comprises a sterol inhibitor.

17. The method of claim 1, wherein said antifungal agent comprises an antifungal agent selected from the group consisting of amphotericin B, ketoconazole, itraconazole, saperconazole, voriconazole, flucytosine, miconazole, fluconazole, griseofulvin, clotrimazole, econazole, terconazole, butoconazole, oxiconazole, sulconazole, ciclopirox olamine, haloprogin, tolnaftate, naftifine,

terbinafine hydrochloride, morpholines, nystatin, natamycin, butenafine, undecylenic acid, Whitefield's ointment, propionic acid, and caprylic acid.

18. The method of claim 17, wherein said antifungal agent comprises an antifungal agent selected from the group consisting of amphotericin B, ketoconazole, itraconazole, saperconazole, and voriconazole.

19. The method of claim 17, wherein said antifungal agent comprises amphotericin B.

20. The method of claim 17, wherein said antifungal agent comprises itraconazole.

21. The method of claim 1, wherein said formulation comprises a pharmaceutically acceptable aqueous vehicle.

22. The method of claim 21, wherein said formulation comprises about 0.01 ng to about 1000 mg of said antifungal agent per liter.

23. The method of claim 22, wherein said effective amount comprises about 0.01 mL to about 1 L of said formulation per nostril of said mammal.

24. The method of claim 22, wherein said effective amount comprises about 5 mL to about 100 mL of said formulation per nostril of said mammal.

25. The method of claim 22, wherein said effective amount comprises about 20 mL of said formulation per nostril of said mammal.

26. The method of claim 21, wherein said formulation comprises about 1 ng to about 500 mg of said antifungal agent per liter.

27. The method of claim 21, wherein said formulation comprises about 100 mg of said antifungal agent per liter.

28. The method of claim 1, wherein said formulation comprises a plurality of antifungal agents.

29. The method of claim 1, wherein said effective amount of said formulation comprises about 0.01 ng to about 1000 mg of said antifungal agent per kg of body weight of said mammal.

30. The method of claim 1, wherein said effective amount of said formulation comprises about 1 ng to about 500 mg of said antifungal agent per kg of body weight of said mammal.

31. The method of claim 1, wherein said effective amount of said formulation remains constant during said effective duration.

32. The method of claim 1, wherein said effective frequency of said mucoadministration is from about four times a day to about once every other week.

33. The method of claim 1, wherein said effective frequency of said mucoadministration is from about twice a day to about once a week.

34. The method of claim 1, wherein said effective frequency of said mucoadministration is more frequent than once a day.

35. The method of claim 1, wherein said effective frequency of said mucoadministration is more frequent than once a week.

36. The method of claim 1, wherein said effective duration is greater than about 7 days.

37. The method of claim 1, wherein said effective duration is greater than about 14 days.

38. The method of claim 1, wherein said effective duration is greater than about 30 days.

39. The method of claim 1, wherein said effective duration is greater than about 60 days.

40. The method of claim 1, wherein said effective duration is greater than about 90 days.

41. The method of claim 1, wherein said formulation comprises a compound selected from the group consisting of pharmaceutically acceptable aqueous vehicles, pharmaceutically acceptable solid vehicles, mucolytic agents, antibacterial agents, anti-inflammatory agents, immunosuppressants, dilators, vaso-constrictors, steroids, and therapeutic compounds.

42. The method of claim 1, wherein said method comprises administering to said mammal a second formulation.

43. The method of claim 42, wherein said second formulation comprises a compound selected from the group consisting of antifungal agents, pharmaceutically acceptable aqueous vehicles, pharmaceutically acceptable solid vehicles, mucolytic agents, antibacterial agents, anti-inflammatory agents, immunosuppressants, dilators, vaso-constrictors, steroids, and therapeutic compounds.

44. The method of claim 1, said method comprising, after said mucoadministration, prophylactically mucoadministering to said mammal a prophylactic formulation in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced rhinosinusitis, said prophylactic formulation comprising an antifungal agent.

45. The method of claim 44, wherein said prophylactic mucoadministration comprises direct mucoadministration.

46. A method for prophylactically treating a mammal at risk for developing non-invasive fungus-induced rhinosinusitis, comprising mucoadministering to said mammal a formulation in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced rhinosinusitis, said formulation comprising an antifungal agent.

47. A method for treating a mammal having a non-invasive fungus-induced rhinosinusitis, comprising the steps of:

a) identifying said mammal, and

b) directly mucoadministering to at least a portion of the nasal-paranasal anatomy of said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced rhinosinusitis, said formulation comprising an antifungal agent.

48. The method of claim 47, wherein said identifying comprises diagnosing.

49. A method for prophylactically treating a mammal at risk for developing non-invasive fungus-induced rhinosinusitis, comprising the steps of:

a) identifying said mammal, and

b) mucoadministering to at least a portion of the nasal-paranasal anatomy of said mammal a formulation in an amount, at a frequency, and for a

duration effective to prevent said non-invasive fungus-induced rhinosinusitis, said formulation comprising an antifungal agent.

50. A method for treating a mammal having asthma, comprising mucoadministering to at least a portion of the airways of said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate symptoms of said asthma, said formulation comprising an antifungal agent.

51. The method of claim 50, wherein said mucoadministration comprises a direct mucoadministration.

52. The method of claim 51, wherein said direct mucoadministration comprises irrigating the nasal-paranasal anatomy of said mammal with a liquid form of said formulation.

53. The method of claim 51, wherein said direct mucoadministration comprises inhaling said formulation through the mouth or nose of said mammal.

54. The method of claim 50, wherein said portion comprises nasal airways.

55. The method of claim 50, wherein said portion comprises lung airways.

56. The method of claim 50, said method comprising, after said mucoadministration, prophylactically mucoadministering to said mammal a prophylactic formulation in an amount, at a frequency, and for a duration effective to prevent symptoms of said asthma, said prophylactic formulation comprising an antifungal agent.

57. A method for prophylactically treating a mammal at risk for developing asthma, comprising mucoadministering to at least a portion of the airways of said mammal a formulation in an amount, at a frequency, and for a duration effective to prevent symptoms of said asthma, said formulation comprising an antifungal agent.

58. A method for treating a mammal having asthma, comprising the steps of:

a) identifying said mammal, and

b) directly mucoadministering to at least a portion of the airways of said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate symptoms of said asthma, said formulation comprising an antifungal agent.

59. A method for prophylactically treating a mammal at risk for developing asthma, comprising the steps of:

a) identifying said mammal, and

b) mucoadministering to at least a portion of the airways of said mammal a formulation in an amount, at a frequency, and for a duration effective to prevent symptoms of said asthma, said formulation comprising an antifungal agent.

60. A method for treating a mammal having non-invasive fungus-induced intestinal mucositis, comprising mucoadministering to said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced intestinal mucositis, said formulation comprising an antifungal agent.

61. A method for prophylactically treating a mammal at risk for developing non-invasive fungus-induced intestinal mucositis, comprising mucoadministering to said mammal a formulation in an amount, at a frequency, and for a duration

effective to prevent said non-invasive fungus-induced intestinal mucositis, said formulation comprising an antifungal agent.

62. A method for treating a mammal having a non-invasive fungus-induced intestinal mucositis, comprising the steps of:

a) identifying said mammal, and

b) mucoadministering to at least a portion of the digestive tract of said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced intestinal mucositis, said formulation comprising an antifungal agent.

63. The method of claim 62, wherein said identifying comprises diagnosing.

64. A method for prophylactically treating a mammal at risk for developing non-invasive fungus-induced intestinal mucositis, comprising the steps of:

a) identifying said mammal, and

b) mucoadministering to at least a portion of the digestive tract of said mammal a formulation in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced intestinal mucositis, said formulation comprising an antifungal agent.

65. A method for treating a mammal having non-invasive fungus-induced otitis media, comprising mucoadministering to said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced otitis media, said formulation comprising an antifungal agent.

66. A method for prophylactically treating a mammal at risk for developing non-invasive fungus-induced otitis media, comprising mucoadministering to said mammal a formulation in an amount, at a frequency, and for a duration effective to

prevent said non-invasive fungus-induced otitis media, said formulation comprising an antifungal agent.

67. A method for treating a mammal having a non-invasive fungus-induced otitis media, comprising the steps of:

a) identifying said mammal, and

b) mucoadministering to at least a portion of the middle ear of said mammal a formulation in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced otitis media, said formulation comprising an antifungal agent.

68. The method of claim 67, wherein said identifying comprises diagnosing.

69. A method for prophylactically treating a mammal at risk for developing non-invasive fungus-induced otitis media, comprising the steps of:

a) identifying said mammal, and

b) mucoadministering to at least a portion of the middle ear of said mammal a formulation in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced otitis media, said formulation comprising an antifungal agent.

70. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be directly mucoadministered to at least a portion of the nasal-paranasal anatomy of a mammal having non-invasive fungus-induced rhinosinusitis in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced rhinosinusitis.

71. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be mucoadministered to at least a portion of the nasal-paranasal anatomy of a mammal at risk for developing non-invasive fungus-induced rhinosinusitis in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced rhinosinusitis.

72. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be directly mucoadministered to at least a portion of the airways of a mammal having asthma in an amount, at a frequency, and for a duration effective to reduce or eliminate symptoms of said asthma.

73. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be mucoadministered to at least a portion of the airways of a mammal at risk for developing asthma in an amount, at a frequency, and for a duration effective to prevent symptoms of said asthma.

74. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be mucoadministered to a mammal having non-invasive fungus-induced intestinal mucositis in an amount, at

a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced intestinal mucositis.

75. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be mucoadministered to a mammal at risk for developing non-invasive fungus-induced intestinal mucositis in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced intestinal mucositis.

76. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be mucoadministered to a mammal having non-invasive fungus-induced otitis media in an amount, at a frequency, and for a duration effective to reduce or eliminate said non-invasive fungus-induced otitis media.

77. An article of manufacture, comprising packaging material and a formulation contained within said packaging material, wherein said formulation comprises an antifungal agent and wherein said packaging material comprises a label or package insert indicating that said formulation can be mucoadministered to a mammal at risk for developing non-invasive fungus-induced otitis media in an amount, at a frequency, and for a duration effective to prevent said non-invasive fungus-induced otitis media.

78. The use of an antifungal agent in the manufacture of a medicament for treating or preventing non-invasive fungus-induced rhinosinusitis.

79. The use as in claim 78, wherein said medicament is mucoadministered to at least a portion of the nasal-paranasal anatomy of a mammal in an amount, at a frequency, and for a duration effective to reduce, eliminate, or prevent said non-invasive fungus-induced rhinosinusitis.

80. The use as in claim 79, wherein said mucoadministration is a direct mucoadministration.

81. The use as in claim 80, wherein said direct mucoadministration comprises irrigating said nasal-paranasal anatomy with a liquid form of said medicament.

82. The use as in claim 80, wherein said direct mucoadministration comprises applying an aerosol form of said medicament to said nasal-paranasal anatomy.

83. The use as in claim 80, wherein said direct mucoadministration comprises applying an powder form of said medicament to said nasal-paranasal anatomy.

84. The use as in claim 79, wherein said effective amount comprises about 0.01 mL to about 1 L of said medicament per nostril of said mammal.

85. The use as in claim 79, wherein said effective amount of said medicament remains constant during said effective duration.

86. The use as in claim 79, wherein said effective frequency of said mucoadministration is from about four times a day to about once every other week.

87. The use as in claim 79, wherein said effective duration is greater than about 7 days.

88. The use as in claim 78, wherein said non-invasive fungus-induced rhinosinusitis is characterized by polyp formation or polypoid change.

89. The use as in claim 78, wherein said non-invasive fungus-induced rhinosinusitis is chronic.

90. The use as in claim 78, wherein said medicament is in a solid, liquid, or aerosol form.

91. The use as in claim 78, wherein said medicament is in a form selected from the group consisting of a powder, crystalline substance, gel, paste, ointment, salve, cream, solution, suspension, partial liquid, spray, nebulae, mist, atomized vapor, aerosol, and tincture.

92. The use as in claim 78, wherein said antifungal agent comprises a macrolide.

93. The use as in claim 78, wherein said antifungal agent comprises an azole.

94. The use as in claim 78, wherein said antifungal agent comprises an antifungal agent selected from the group consisting of amphotericin B, ketoconazole, itraconazole, saperconazole, voriconazole, flucytosine, miconazole, fluconazole, griseofulvin, clotrimazole, econazole, terconazole, butoconazole, oxiconazole, sulconazole, ciclopirox olamine, haloprogin, tolnaftate, naftifine, terbinafine hydrochloride, morpholines, nystatin, natamycin, butenafine, undecylenic acid, Whitefield's ointment, propionic acid, and caprylic acid.

95. The use as in claim 78, wherein said medicament comprises a pharmaceutically acceptable aqueous vehicle.

96. The use as in claim 95, wherein said medicament comprises about 1 ng to about 500 mg of said antifungal agent per liter.

97. The use as in claim 95, wherein said medicament comprises about 100 mg of said antifungal agent per liter.

98. The use as in claim 78, wherein said medicament comprises about 0.01 ng to about 1000 mg of said antifungal agent per liter.

99. The use as in claim 78, wherein said medicament comprises a plurality of antifungal agents.

100. The use as in claim 78, wherein said medicament comprises a compound selected from the group consisting of pharmaceutically acceptable aqueous vehicles, pharmaceutically acceptable solid vehicles, mucolytic agents, antibacterial agents, anti-inflammatory agents, immunosuppressants, dilators, vaso-constrictors, steroids, and therapeutic compounds.

101. The use of an antifungal agent in the manufacture of a medicament for treating or preventing asthma.

102. The use as in claim 101, wherein said medicament is mucoadministered to at least a portion of the airways of a mammal in an amount, at a frequency, and for a duration effective to reduce, eliminate, or prevent symptoms of said asthma.

103. The use of an antifungal agent in the manufacture of a medicament for treating or preventing non-invasive fungus-induced intestinal mucositis.

104. The use as in claim 103, wherein said medicament is mucoadministered to a mammal in an amount, at a frequency, and for a duration effective to reduce, eliminate, or prevent symptoms of said non-invasive fungus-induced intestinal mucositis.

105. The use of an antifungal agent in the manufacture of a medicament for treating or preventing non-invasive fungus-induced otitis media.

106. The use as in claim 105, wherein said medicament is mucoadministered to a mammal in an amount, at a frequency, and for a duration effective to reduce, eliminate, or prevent symptoms of said non-invasive fungus-induced otitis media.

107. An antifungal formulation comprising an antifungal agent, a flavoring, and water, wherein said water comprises at least about 50 percent of said formulation.

108. The antifungal formulation of claim 107, wherein said water comprises at least about 75 percent of said formulation.

109. The antifungal formulation of claim 107, wherein said water comprises at least about 85 percent of said formulation.

110. An antifungal formulation comprising an antifungal agent, a flavoring, and water, wherein said water comprises at least about 50 percent of said formulation, and wherein said antifungal agent comprises an antifungal agent selected from the group consisting of amphotericin B, ketoconazole, saperconazole, voriconazole, flucytosine, miconazole, fluconazole, griseofulvin, clotrimazole, econazole, terconazole, butoconazole, oxiconazole, sulconazole, ciclopirox olamine, haloprogin, tolnaftate, naftifine, terbinafine hydrochloride, morpholines, nystatin,

natamycin, butenafine, undecylenic acid, Whitefield's ointment, propionic acid, and caprylic acid.

111. An antifungal formulation comprising itraconazole and water, wherein said itraconazole is dissolved in said formulation at a concentration greater than about 25 μg per mL and wherein said water comprises at least about 50 percent of said formulation.

112. The antifungal formulation of claim 111, wherein said formulation comprises polyethylene glycol.

113. The antifungal formulation of claim 111, wherein said formulation comprises a flavoring.

114. An antifungal formulation comprising itraconazole and water, wherein said itraconazole is suspended in said formulation at a concentration greater than about 25 μg per mL and wherein said water comprises at least about 50 percent of said formulation.

115. A method of making an antifungal formulation, said formulation comprising itraconazole and water, wherein said itraconazole is dissolved in said formulation at a concentration greater than about 25 μg per mL and wherein said water comprises at least about 50 percent of said formulation, said method comprising adding said water to a stock solution containing said itraconazole.

116. A method for culturing fungus from a mammal's mucus, said method comprising:

a) contacting said mucus with a mucolytic agent to reduce the viscosity of said mucus,

b) separating said fungus from said reduced-viscosity mucus,

c) contacting said separated fungus with fungus growth medium to form a fungus culture, and

d) incubating said fungus culture such that said separated fungus grows.

117. A method for obtaining a fungal antigen, said method comprising:

a) contacting a mammal's mucus with a mucolytic agent to reduce the viscosity of said mucus,

b) separating fungus from said reduced-viscosity mucus,

c) contacting said separated fungus with fungus growth medium to form a fungus culture,

d) incubating said fungus culture such that said separated fungus grows, and

e) isolating said antigen from said cultured fungus.

118. A method for producing a fungus-specific antibody, said method comprising:

a) contacting a mammal's mucus with a mucolytic agent to reduce the viscosity of said mucus,

b) separating fungus from said reduced-viscosity mucus,

c) contacting said separated fungus with fungus growth medium to form a fungus culture,

d) incubating said fungus culture such that said separated fungus grows,

e) isolating a fungal antigen from said cultured fungus, and

f) immunizing an animal with said fungal antigen to produce said antibody.

119. A nasal mucus collecting apparatus, comprising:

a) a collection retainer, said collection retainer being suitable for retaining mucus,

b) a collection tube extending from said collection retainer, wherein said collection tube defines a distal end and a lumen such that mucus can traverse said lumen from said distal end of said collection tube to said collection retainer, said collection tube being generally flexible over at least a portion of the length of said collection tube such that said collection tube can be selectively manipulated into a desired configuration by a practitioner during a collection procedure, said collection tube further being generally malleable such that said collection tube generally retains said desired configuration until the practitioner manipulates said collection tube to conform to a different configuration, and

c) a connecting portion extending from said collection retainer, wherein said connecting portion defines a second lumen that communicates with the interior of said collection retainer, said connecting portion being adapted to receive a vacuum source.

120. The apparatus of claim 119, wherein said apparatus comprises a valve that adjusts the opening of said second lumen.

121. The apparatus of claim 119, wherein said collection retainer is removable from said collection tube and said connection portion.

122. A pharmaceutical composition comprising an antifungal agent.

123. A pharmaceutical composition comprising an antifungal agent and a mucolytic agent.

124. A pharmaceutical composition comprising an antifungal agent and a steroid.

125. A pharmaceutical composition comprising an antifungal agent and a decongestant.

126. A pharmaceutical composition comprising an antifungal agent and an antibiotic.

127. A pharmaceutical composition comprising an antifungal agent and an anti-inflammatory.

128. A composition for treating an immune response to fungus in a mammal, characterized by an agent configured for direct mucoadministration to the mucus of the mammal and having antifungal means for eliminating or reducing the fungus below a threshold level wherein the fungus ceases to activate eosinophile migration to the affected area.

129. A pharmaceutical composition for treating a fungal related condition in the nasal-sinus anatomy, pulmonary anatomy, ear anatomy, or intestinal anatomy of a mammalian patient, said composition comprising an effective dose of an anti-fungal as described herein.

130. A pharmaceutical composition for treating a fungal related condition in the nasal-sinus anatomy, pulmonary anatomy, ear anatomy, or intestinal anatomy of a mammalian patient, said composition comprising an effective dose of an anti-fungal and at least one other agent or inhibitor as described herein.

131. A pharmaceutical composition for treating a fungal related condition in the nasal sinus anatomy, pulmonary anatomy, ear anatomy, or intestinal anatomy of a mammalian patient, said composition comprising an effective dose of an anti-fungal suitable for long term use within the nasal-sinus anatomy.

132. A medication for treating sinusitis, asthma, otitis media, or colitis of a patient, comprising a mucolytic agent; and an anti-fungal compound as described herein.

133. An irrigation medication for treating an inflamed nasal area, lung area, ear area, or intestinal area of a patient, the inflamed nasal area, lung area, ear area, or intestinal area being caused by the presence of a fungus, the medication comprising effective doses of an antifungal compound and a steroid as described herein.

134. An irrigation medication for treating an inflamed nasal area, lung area, ear area, or intestinal area of a patient, the inflamed nasal area, lung area, ear area, or intestinal area being caused by the presence of a fungus, the medication comprising effective doses of an antifungal compound and a mucolytic agent.

135. An irrigation medication for treating an inflamed nasal area, lung area, ear area, or intestinal area of a patient, the inflamed nasal area, lung area, ear area, or intestinal area being caused by the presence of a fungus, the medication comprising effective doses of a steroid and a mucolytic agent as described herein.

136. An irrigation medication for treating an inflamed nasal area, lung area, ear area, or intestinal area of a patient, the inflamed nasal area, lung area, ear area, or intestinal area being caused by the presence of a fungus, the medication comprising effective doses of an antifungal compound, a steroid, and a mucolytic agent as described herein.

137. An irrigation medication for treating an inflamed nasal area, lung area, ear area, or intestinal area of a patient, the inflamed nasal area, lung area, ear area, or intestinal area being caused by the presence of a fungus, the medication comprising an effective dose of at least one medicine selected from the group consisting of an antifungal compound, a steroid, a mucolytic agent, and any combination thereof as described herein.